# NASA SBIR/STTR Technologies

# Advanced Crew Escape System Simulation Tool for Future Launch Vehicles

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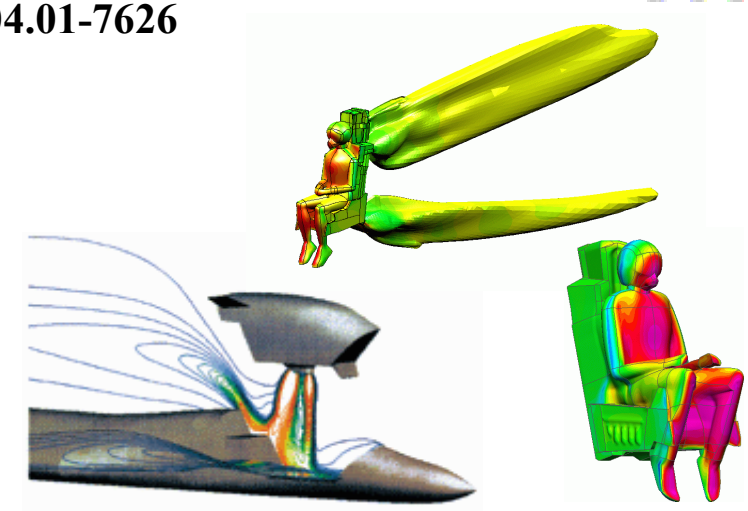
## Description and Objectives

Development of integrated CFD, 6-DoF and blast wave simulation tool for RLV crew escape system design and analysis.

- Builds on proven military crew escape systems simulation program applicable across flight regime (reactive flow solver, Chimera grids, 6-DoF).
- Develop and integrate blast wave physics model to simulate launch vehicle explosion impact.
- Provide cross-cutting technology, applicable to all RLV architectures and for all crew escape systems, ejection seats to crew vehicles.
- Phase I: Integrate blast wave models simulating launch vehicle explosion into pre-existing simulation suite. Demonstrate application of technology for high speed ejection and CTV abort, including blast wave effects
- Phase II: Refine models and improve simulation speed/accuracy through solution adaptive algorithms. Demonstrate and validate for 2nd Gen RLV.



Ejection Seat and Capsule Crew Escape System Simulations

## Approach

- Pre-existing robust, reliable flow solver for hypersonic thermo-chemical 3-D flow simulation
- Overset Chimera grid approach with tightly coupled 6-DoF and prescribed motion models for multi-body dynamics
- Develop and integrate simplified blast wave physics models derived from analytical models and SLI Cycle I explosion test data
- Simulate crew escape system functionality for ejection seats and crew vehicles over flight regime
- Assess functionality of escape system under explosion effects and probability of successful escape.

## Subcontractors/Partners

None

## Schedule and Deliverables

| TASK DESCRIPTION | Months After Receipt of Contract | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Task 1. Assess Extension of Crew Escape Technology to Space Vehicles | | | | | | |
| Task 2. Demonstrate Crew Escape Simulation over Flight Regime | | | | | | |
| Task 3. Develop Blast Wave Model | | | | | | |
| Task 4. Demonstrate Blast Wave Effect Simulation | | | | | | |
| Task 5. Identify and Plan Modeling Improvements | | | | | | |
| Task 6. Prepare Final Report | | | | | | |

Deliverable

Mature staging and crew escape system simulation tool applicable across flight envelope.

## NASA & Commercial Applications

- Direct and immediate applications in 2nd Gen and 3rd Gen RLV crew escape,
- Enables NASA and SLI contractors in crew escape concept definition, evaluation and verification of designs not possible with ground/flight tests,
- Store release and crew escape from hypersonic military aircraft systems,
- Missile proximity warhead effectiveness